

Sorting Code: 99-NCERQA-B I

Title: Vulnerability of young children to Organophosphate Pesticides and selected metals through intermittent exposures in Yuma County, Arizona.

Investigators: M. K. O'Rourke, (1) Ph.D., M.D. Lebowitz, (1) Ph.D.; A. Aguirre (2) M. S., M. Nishioka (3) M.S., N. C. Freeman (4) Ph.D. M.P.H.

Institutions: *The University of Arizona, (1) Western Arizona Health Education Center (2), Battelle Memorial Institute (3), EOHSI at the R. W Johnson Medical Center/Rutgers University (4)*

Project Period: May 1, 1999 through April 20, 2002

Research Category: Children's Vulnerability to Toxins in the Environment

Project Summary:

Background: Children are the most susceptible population to environmental contaminants since: (a) their organs and neurological system are rapidly developing; (b) their intake (air, water, food, beverage) is greater relative to body size and weight; (c) their activities, behavior and proximity to the surfaces enhance their potential contact with toxic substances. The NHEXAS and Border Surveys of Arizona document multimedia, multi-pathway exposures in Arizona across the population as determined using a population based probability design. Preliminary results from Yuma County suggest enhanced exposure to pesticides, lead and manganese. Local agriculture, secondary exposure to those occupationally exposed, suboptimal housing stock, and reduced body coverage by clothing to combat the heat, are factors that may enhance exposure to OP pesticides and some metals. Our **goal** is the accurate determination of the routes and amounts of exposure experienced by young children. We will measure rates of dermal contact, hand to mouth, and mouthing activity, among children using video tape methods. We will evaluate media contacted by children (air, house dust, hands) for concentrations of 9 OP pesticides commonly used in the area (including chlorpyrifos, diazinon and malathion). Lead, manganese and other metals will be measured in house dust by XRF. We will test the **null** hypotheses that (1) frequent intermittent contact with contaminated surfaces is not associated with elevated urinary metabolite yield, (2) contaminant levels found in the handled food of children will *not* differ from that of unhandled food (as determined by NHEXAS, Border and Children's Pesticide Surveys); (3) exposure through intermittent contact will not significantly increase the total exposure for children. (4) *No* differences in hand to mouth activity will be evident in a subset of children evaluated longitudinally within 1 year. A **Quality Assurance Project Plan** will be developed prior to entering the field and implemented throughout the project. Testing these hypotheses will be *approached* using a *nested study design* of potty trained children 2.5-3.9 years of age. The population will be recruited through local clinics, Head Start, and WIC programs. We expect over 90% of the population to be low SES Hispanics consistent with local census results. **Phase 1:** Urine will be collected from 210 children and an OP screen will evaluate metabolites. Two groups of children (n = 30 each) will be selected using this screen. One group will reflect elevated urinary metabolites to OPs; the other low. Groups will be matched by age, gender, ethnicity, day-care status and proximity of households to fields. **Phase 2:** A multimedia, multipathway, and behavioral assessment will be made of the children and their environments. Indoor air, carpet dust, and dermal surfaces will be evaluated for pesticide concentrations. Questionnaires previously used in the NHEXAS, Border and Children's Pesticide Survey will be administered for comparison. Additional questions and observations will be asked regarding the child's mouthing and hand to mouth contact. **Step 3:** Concurrent with environmental sampling, each child will be video taped for 16 (waking) hours over the course of two days. Duration of intermittent contacts with various surfaces by each hand and the mouth will be measured for duration and summed over the day. Dermal collections will be made to correspond with the videotaping periods. A second urine assay for specific pesticide metabolites will be evaluated in conjunction with the assessment of environmental media. Ten children each from Group 1 and Group 2 will be reevaluated after 1 year.

Data analysis: Univariate and summary statistical analysis and hypothesis testing will be performed using SPSS to evaluate the distributions of the variables and contact classes. Distributions of measures within the two groups and

across previous studies will be statistically compared and modeled using parametric and non-parametric statistics. Further, exposure models developed for the NHEXAS, Border and Children's pesticide surveys will be used with these data for the population as a whole (n 60) and each group separately. Missing variables will be estimated from NHEXAS, Border, and Children's pesticide databases when appropriate. Modeled results will be compared and the impact of the revised exposure constants evaluated.

Expected Results: We expect to find (1) elevated urinary metabolites indicative of OP exposure among children with (a) elevated contact with surfaces, (b) greater hand to mouth activity, and (c) frequent mouthing behavior. The relationship is probably exponential. (2) We expect a wide range of intermittent contact behavior among children and we expect the difference to be quantifiable among the 2 groups (case and control). (3) We expect exposure to decline as the children of both groups age. Exposure between the groups will begin to converge with time. (4) We expect to reduce children's exposures through education of parents, decision makers and health educators.

Improvements in Risk Assessment and Risk Management: Current exposure factors for children appear based on unvalidated subjective reports. We believe they grossly under represent the amount of contaminant ingested and dermally absorbed by children. Experimentally derived factors could only enhance exposure assessment models. Further, this case control approach will help identify factors that minimize exposure. If the expected trends materialize, mitigation recommendations could be made to health educators, policy makers and parents.

Supplemental Keywords: Indoor air, PUF, GUMS, Chlorpyrifos, Diazinon, Malathion, 2-3 TCPY, dermal wipes, immunoassay, environmental chemistry, time-activity diaries, diary validation, automated data entry.